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ABSTRACT

This report describes the results of a series of studies that attempted to measure the effect of an electric feedback system on student performance. The first study, using two different sections of the same course taught by the same instructor, tried to determine how often students spontaneously admit confusion and ask the instructor for clarification. The results indicated that the students rarely did so, fearful of appearing stupid in front of the class. There also seemed to be little relationship between amount or type of participation and student achievement. It was hypothesized that if students could admit their confusion anonymously, these admissions would permit an instructor to make his presentation to the class more effectively. To examine the effect of such a system, four additional studies were conducted, each of which examined another use or aspect of the Anonymous Feedback System, an electronic student response system. Though students at times profited from the system, no general statement could be made concerning either the benefits or negative effects of the system. (AF)

Evaluation of an Anonymous Feedback System in College Classes

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As college classrooms have enlarged, in order to meet the damand for higher education, the instructor has become more like an information broadcaster and the student has been expected to be a passive information recorder. The difference between broadcasting and communicating is the difference between a one-way and a two-way street. Broadcasting does not allow for exchanges of viewpoint or a dialogue between interested participants. In the large lecture there is little chance for a student to interact or debate with the instructor even if the instructor is coming to the students "live." Of course, why should schools provide students with the chance to interact? What are the motives for these interactions and do these motives or effects justify the expense of providing live instructors and small classrooms?

An instructor presenting a lecture is a component in a system of information transmission. The goal is usually an attempt to transfer 'x' amount of information from the texts and instructor's knowledge into the heads of the students. Like any system, its efficiency is dependent on its ability to measure error (difference between ideal output and actual output) and to use this error to

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modify its performance (Figure 1). Feedback, in terms of knowledge of results is necessary for any organism or system to consistently improve its performance. The students in our classroom system receive a good deal of feedback concerning their behaviors and achievement but what about the instructors?

Some instructors feel confident in their abilities to present materials if the students do well on exams. Other instructors feel confident regardless of the students' performance. In any case, the class' performance on examinations is based on many factors besides, and perhaps in spite of, the actual classroom presentation. Also, class performance on exams comes too late for the instructor to use this information in modifying his presentation.

Some instructors feel that they can tell from the students' verbal and non-verbal behaviors, during their presentation, whether or not the students comprehend the material. Jecker, Maccoby, Breitrose and Rose (1964) and Jecker, Maccoby and Breitrose (1965) suggested that even experienced teachers could not accurately determine a student's comprehension from non-verbal cues. As for the quality, quantity and effect of students' comments in the classroom, little research has been done.

Study #1

In the first study, I attempted to observe and classify all student verbalizations in two undergraduate classes. In particular, I wished to answer the question,

"How often do students admit confusion and ask the instructor for clarification?"

Some personality theories seemed useful in predicting the type of students who would actively participate in classroom discussions.

In studying fifth graders, Ccopersmith (1967) observed that high self-esteem students were more comfortable about speaking up in groups. Kipnis (1968 a,b) observed that immature college students were more noticeable tc their instructors than were other students. Students who are high on internal locus of control should speak out and direct their destinies more than external locus of control individuals. All of these hypotheses were examined in the first study.

Methodology

Subjects: Two different sections of the same course taught by the same instructor were used as subjects. One class had 42 students while the other had 40. The classes did not significantly differ on grade point averages (GPA), personality test scores or grades in the course as tested by t-tests of their mean differences.

Procedures: All the verbalizations throughout the semester were categorized by an observer in the class utilizing the Student Response Classification System (SRCS). This system (see Table 1) was created for this study though it does share similarities with the classroom interaction

systems developed by Hough (Amidon and Hough, 1967).

The inter-rater reliability of the SRCS was examined three times. Two raters observing the same class at the same time agreed on 88% of the students' responses for 165 student verbalizations.

The personality variables were measured by paper and pencil tests administered early in the semester. Coopersmith's (1967) Self-Esteem Inventory was slightly modified for the college population but it is believed to give a fair indication of a college student's self-esteem.

Immaturity was measured by utilizing two scales which have veen used with college populations before, the Socialization scale of the California Psychological Inventory and the Insolence scale (see Kipnis,1968 a,b). To assess the student's locus of control, a 60-item scale developed by Rotter, Seeman and Liverant (1962) was used.

Results

Though the classes did not differ on the personality measures or the academic measures (pretest, grade point average, or course grades) they were highly different in amount and type of verbalizations (Table 1, Figure 2).

Not only do the classes differ in quantity of verbalizations (Tables 1, 2) but also in the differential percentages of types of responses (Table 4). In class 1, most responses were volunteered by the students after the

teacher made a comment,while in class II, the most popular type of response were those initiated by the student with no obvious stimulus from the instructor.

In both classes, students admitting confusion or asking for clarification were rare phenomena. Even when these rare responses were combined with asking questions, these responses accounted for only 24% of the comments in class 1 and 32% in class 2 (Table 4).

The variabilities between these two classes were further demonstrated when the correlations between student responses and personality variables were examined. The correlations between these variable differed widely from one class to the other (Table 5). The only consistent findings in both classes were that different types of verbalizations were highly correlated with each other. In other words, students who ask questions are likely to answer questions or make other comments. No consistencies were found between student participation and course grades.

An attempt to discover differences between the students' attitudes in the two classes was not successful since the classes did not differ in their responses to a questionnaire concerning speaking up in the classroom (Table 5).

Discussion

This preliminary study demonstrated that students rarely admit confusion or ask an instructor for clarification. On a questionnaire, they admitted that they were

fearful of appearing stupid in front of the class.

Some secondary findings were that there did not seem to be any generalizeable relationships between several personality factors and student participation. In fact, there were no consistent relationships between amount or type of participation and student achievement. It was found, however, that some students were consitently active while others were consistently inactive in the classroom. Further, students who asked questions were also the students who answered questions or otherwise participated.

Introduction to Studies #2-5

From study #1 it was hypothesized that if students could admit their confusion anonymously, th n these admissions would permit an instructor to couple his presentation to the class' comprehension more effectively.

In order to examine the effects of such a system, four independent studies were conducted. Each examined another use or aspect of the Anonymous Feedback System. Hopefully, this broad type of exploration will, if consistent results are found, allow for greater generalizeability (Campbell and Stanley, 1963).

In each study two different sections of the same undergraduate course were used as subjects. Each course had a different instructor. Since these were agricultural economics classes, the subject population was almost completely male.

The equipment used was developed for this series of studies. The Anonymous Feedback System consisted of from one to fifty footswitches, attached to a teacher's console and a memory unit. The teacher's console consisted of a light display board on which one bulb represents each footswitch. The memory unit was a group of small three-digit counters, each of which represented the total number of times which the footswitch had been depressed.

The footswitches could be attached to the light console so that the instructor could or could not identify which students were depressing the footswitches. Regardless of whether the instructor could identify the student using the footswitch, it was possible for the researcher to keep a tabulation of how often the system was being used by each student.

In order to evaluate learning or scholastic achievement daily quizzes, hour examinations, final grade scores or all three were used as dependent variables. Final grades represented a weighted summation of all graded work throughout the semester.

It was hoped that each of the four experimental studies could utilize an analysis of variance design but in at least one study (#4) the groups differed on grade point averages (GPA) at the outset. Since in study #1, it found that there was a significant correlation between GPA and final course grades, an analysis of covariance was calculated with GPA being the covariant.

Study #2

Hypothesis: Students would learn better if they were more able to communicate their level of understanding to a lecturer and he were better able to assess the class' comprehension.

Procedure: Half of the students in each of two sections of the same course were randomly given footswitches. They were instructed to use these footswitches to indicate confusion anonymously to their instructor. In one class, this feedback was available to the instructor and in the other class this feedback was hidden from him.

Results: On unannounced sporadic quizzes covering the day's lecture, the students in the class in which the teacher could see the feedback did no better than the class in which the teacher could not see the feedback. While there was no difference between the students with and without footswitches in the class with the available feedback, in the class in which the instructor could not see the console, the students with the footswitches out-performed the students without (Table #7).

On announced hourly examinations the class in which the instructor received the feedback outperformed the class in which the console was hidden from view. In the class in which the console was hidden the students with the footswitches did worse than those without while in the class in which the console was visible the students with the footswitch did better (Table 8). These same effects were found

on final grade scores in addition to hourly examinations.

It was also found that the students in the class in which the instructor could not see the console used the system more than the students in the class with the fully operative AFS.

Discussion

An electric feedback system (AFS) improved students' performance as measured by announced hour examinations and final scores. Quizzes, covering only the material presented during that classroom period, were thought to be the most sensitive criteria of classroom learning. On these quizzes the classes did not differ.

It was interesting to find that the effect of a student having a footswitch and the opportunity to participate via the Anonymous Feedback System, was quite variable as to the class and as to the dependent variable. Obviously, having this ability is not always beneficial.

Study #3

One of the assumptions of the AFS is that anonymity improves the frequency of confusion feedback and this will lead to increased efficiency of presentation. From this, the hypothesis was generated that a class with anonymous confusion feedback will learn better than a class in which the feedback was not anonymous.

Procedure: Two sections of the same course taught

by the same instructor were used as subjects. Half of the students in each class randomly received footswitches. In one class, the light console of the AFS (see Study #2) was arranged so the instructor could not identify the students, indicating confusion while in the other the teacher could identify the students. The students were told under which condition they were operating.

Results

The students, in the class in which the teacher could identify the students indicating confusion, received higher grades on the unannounced quizzes, hour examinations and final grade scores. Though the students who did not have footswitches consistently received slightly higher grades than those with footswitches, the difference was not significant (Tables 9 and 10).

The classes did not differ in the amount the AFS was used.

Discussion

It was obvious from this study that the rationale for an anonymous system was unsupported by data. The class in which the teacher could not identify the confused students did not learn better nor report confusion more often. In fact, the class in which the teacher could identify the students received better grades.

Study #4

The previous studies left many unanswered questions. Two of these were, "Does a class with a fully operative AFS outperform a class with no new equipment?" and "What are the effects of the AFS on the students' verbal activities in the classroom?" This study attempted to answer these questions.

Procedure

Two sections of the same undergraduate course taught by the same instructor served as subjects. One class utilized a fully operative AFS with a footswitch for each student. The other class had no new equipment. The verbal responses of the students were categorized by the student response system (SRCS) explained in Study #1.

Since the classes were different in GPA at the outset of the study, analyses of covariance were utilized with GPA being the covariant.

Results

The two classes did not differ on quizzes, exams or final scores. The class without the AFS was more than twice as active verbally as the class with the AFS (Table 11). However, the less active class expressed more confusion and asked slightly more questions (Table 12).

Discussion

In this study, the AFS failed to improve the learning environment in a college classroom as measured by students' performances on quizzes, exams and final scores.

However, the AFS did seem to have a differential effect on the type of verbal participation in the college classroom. From Study #1, it was expected that the class which was more active would also ask more questions and express more confusion. Though the class with the AFS was less verbally active, they expressed twice as much confusion as the class without the AFS.

It is possible the equipment as well as the research atmosphere sensitized the students to their own confusion and permitted them to verbally express this. This did not improve their performance on quizzes, exams or final grade scores.

Study #5

Since this examination of feedback channels began with the condemnation of the usual lecture and examination procedure, this study attempted to examine the effects of testing students during the presentation. The AFS was used as method for examining students' comprehension during a lecture and feeding this information back to the instructor.

Procedure

Two sections of the same undergraduate course taught

by the same instructor served as subjects. Each class received three announced hour examinations during the semester. Each exam covered the material presented in the previous third of the course. In the experimental class (Class 1), the AFS was installed during the second third of the course. The instructor, during his presentations, asked the class questions with two possible answers. From the lights on the teacher's console, he knew which students answered correctly. These responses were recorded and the teacher used this information to help him pace his lecture.

Results

The two classes did not differ significantly on any of the three examinations. However, the largest discrepancy was on the second exam which followed the experimental use of the AFS (Table 13, Figure 3). Though not significant, this suggests that continually testing students during classroom presentations may have a disruptive effect on student performance.

Discussion

Though none of the results was significant, this study suggested that continually testing students' comprehension during lecture presentations may negatively effect student learning as measured by examinations.

Summary

This research marks one of the first multi-study investigations into the effects of an electronic student response system on college student performance. The effects of new technology are not simple but are often multidemensional. As McLuhan points out, "The message of any medium or technology is the change of scale or pace or pattern that it introduces into human affairs"(1964).

The Anonymous Feedback System offered students a means of becoming more involved in the college classroom. Instead of being passive recipients of broadcasted information, it permitted them to help direct the lecture and express their confusion easily, non-disruptively, even anonymously. Though at times, the students profited from the system, it was very evident that how the system was used and the particular criterion of learning were crucial. No general statement could be made concerning either the beneficial or negative effects of the AFS. In fact, the extreme variability in classroom behaviors suggests that general statements in this area would be premature.

The further study of classroom behaviors, student-teacher channels of communication, and their effects on achievement are certainly indicated. As college classrooms grow and become more impersonal, allowing for fewer student-teacher exchanges, the effects or the quality of higher education are unclear. Perhaps classroom activities are

irrelevant to test performance since the students' ability to study and perform on examinations may outweigh all other variables. Certainly, classroom interactions, which are beneath the noses of all educational researchers and teachers, are worthy of study. What goes on in the classroom, why it goes on, and what effects these happenings have are vital information if we are to change classrooms for the better.

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Figure 1. The feedback principle

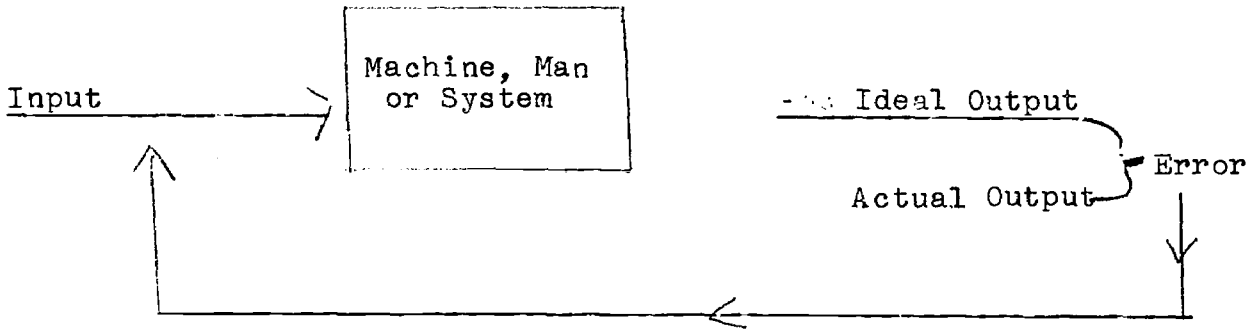

Table 1, Student Response Classification System

	A Spontaneous	B Directed at Class	C Directed at Student
1. Answers a question			
2. Asks a question			
3. States an Opinion			
4. Gives a fact			
5. Admits confusion			
6. Miscellaneous			

Table 2. Total Responses throughout the semester.

	Class I	Class II
Total Responses	752	1365
Type A	170	586
Type B	432	539
Type C	150	240
Type B_1	303	481
Type C_1	147	232
Type 2	174	433
Type 5	8	5

Figure 2. Total class participation

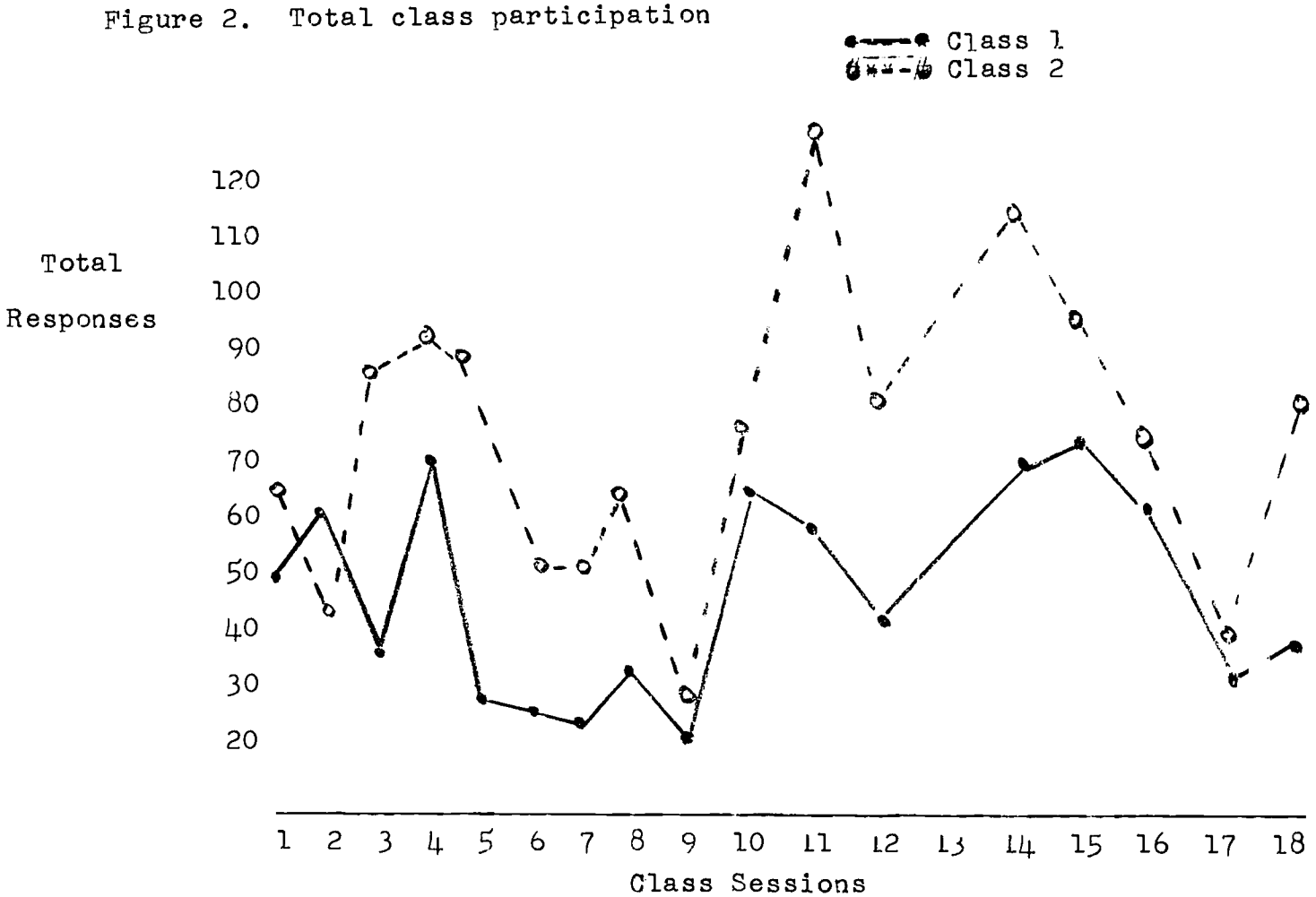

Table 3. Average Responses Per Student For the Semester

	Class I N=42 X	Class I N=42 S.D.	Class II N=40 X	Class II N=40 S.D.
Total (A+B+C)	17.9047	18.1026	34.1250	33.5247
A	4.0476	7.0910	14.6500	18.2449
B	10.2857	12.0974	13.4750	14.9097
C	3.5714	2.0719	6.0000	4.1653
B_1	7.2142	9.2287	12.0250	13.4619
C_1	3.5000	2.0324	5.8000	4.1121

Table 4. Percentages of Different Types of Responses

	Class I N=42	Class II N=40
A- Student initiated responses	22.60%	42.86%
B- Student volunteered responses	57.45%	39.49%
C- Instructor initiated responses	19.95%	17.58%
Answers volunteered	40.29%	35.24%
Asks or admits confusion	24.07%	32.09%
Admits confusion	1.06%	.37%

Table 5. Correlations between independent variables.

Class 1 N=42

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.0	.02	.06	-.04	-.15	-.01	-.03	.02	.17	.22	.13	.21	.19
2		1.0	.20	.09	.37*	.11	-.17	.17	.11	.17	.11	.16	.15
3			1.0	.04	.08	.78**	-.18	.00	.02	-.18	.06	-.00	-.05
4				1.0	.42**	.25	.05	.05	.05	.02	.15	.03	-.01
5					1.0	.10	.00	.11	.24	.01	.12	.10	-.04
6						1.0	-.00	-.18	-.11	-.19	-.07	-.17	-.22
7							1.0	-.00	-.01	-.03	.22	-.02	.01
8								1.0	.87***	.95***	.20	.99***	.91***
9									1.0	.70***	.10	.88***	.63***
10										1.0	.07	.96***	.98***
11											1.0	.09	.06
12												1.0	.914***
13													1.0

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

X1 : Index
X2 : Self-Esteem
X3 : Locus of Control
X4 : Socialization
X5 : Insolence
X6 : Acad.Locus of Control
X7 : Pretest

X8 : Total Responses
X9 : Type A Responses
X10 : Type B Responses
X11 : Type C Responses
X12 : Type A & B Responses
X13 : Type B_1 Responses

Table 5. (Cont.) Correlations between independent variables.

Class 2 N=40

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.0	-.07	-.05	-.12	-.05	.02	.37*	-.02	-.09	.09	-.10	-.01	.08
2		1.0	.18	-.27	.13	.03	.11	-.24	-.16	-.30	-.21	-.23	-.32*
3			1.0	.15	.26	.81***	.38*	.05	.11	-.03	.02	.05	-.05
4				1.0	.30	.28	-.36*	.01	-.11	.05	.38	-.05	.05
5					1.0	.05	-.07	-.18	-.22	-.14	-.04	-.20	-.14
6						1.0	.24	.02	.02	.02	.13	.01	-.03
7							1.0	-.23	-.11	-.26	-.41**	-.19	-.25
8								1.0	.93***	.94***	.63***	.99***	.93***
9									1.0	.75***	.39*	.95***	.74***
10										1.0	.67***	.92***	.99***
11											1.0	.55***	.65***
12												1.0	.91***
13													1.0

* $p \geq .05$
** $p \geq .01$
*** $p \geq .001$

X1 : Index
X2 : Self-Esteem
X3 : Locus of Control
X4 : Socialization
X5 : Insolence
X6 : Acad.Locus of Control
X7 : Pretest
X8 : Total Responses
X9 : Type A Responses
X10 : Type B Responses
X11 : Type C Responses
X12 : Type A & B Responses
X13 : Type B_1 Responses

Table 6. Percentages of responses to Student Reaction Questionnaire.

	Statement	% True Class I	% True Class II
1.	I believe that "speaking up" in class makes a favorable impression on the teacher	.905	.900
2.	I don't like to be called on in class	.405	.250
3.	I am often afraid that I will appear "stupid" in front of the class when I am called on.	.500	.475
4.	I sometimes speak up in class to impress the instructor.	.286	.350
5.	I like to express myself publically in class	.500	.475
6.	I publically admit when I am confused so the teacher can help me understand the lecture.	.548	.550
7.	I believe that the less you stand out in a class the better.	.143	.125
8.	If you don't understand something you shouldn't admit it.	.119	.025
9.	People who speak up in class are trying to show off.	.095	.050
10.	I don't speak up in class because I am shy.	.262	.450
11.	I often speak out in class and answer questions.	.381	.350
12.	I hardly ever speak out in class	.524	.475
13.	If I know the right answer to a question I will raise my hand to answer it.	.786	.625
14.	I don't offer any public comments in class because I am afraid of appearing stupid.	.333	.225
15.	I feel that it is the student's job to participate in the classroom.	.810	.925
16.	Other students don't like you when you speak up in class too often	.476	.475

Table 7. Effects of footswitches and console feedback on daily quizzes (average semester total per group)

	Class 1 (Console Hidden from Instructor	Class 2 (Console Visible to Instructor)	
Footswitches	126.58	118.95	122.67
No footswitches	116.76	118.95	117.92
	121.94	118.95	

ANOV

Source	d.f.	m.s.	F
(class) A	1	168.0066	2.7345
(footswitch) B	1	422.4017	6.8752**
AB	1	451.8165	7.3540**
within	296	61.4377	

**p<.01

Table 8. Effects of footswitches and console feedback on hour examinations (average semester total per group)

	Class 1 Console not visible	Class 2 Console visible	
Footswitches	346.79	378.10	362.85
No footswitches	367.00	367.84	367.44
	356.33	373.10	

ANOV

Source	d.f.	m.s.	F
(class) A	1	5264.5731	8.8598**
(footswitch) B	1	395.8485	.6661
AB	1	4350.7400	7.3219**
within	296	594.2077	

**p<.01

Table 9. Effect of anonymity and footswitches on quizzes (average semester total per group)

	Class 1 Identifiable	Class 2 Anonymous	
Footswitches	129.77	121.25	125.66
No footswitches	131.41	124.95	128.06
	130.70	123.47	

ANOV

Source		d.f.	m.s.	F
(Class)	A	1	1763.2253	26.5320**
(Footswitches)	B	1	201.0197	3.0248
	AB	1	40.7363	.6129
Within		552	66.4564	

**p<.01

Table 10. Effect of anonymity and footswitches on examinations (average semester total per group).

	Class 1 Identifiable	Class 2 Anonymous	
Footswitches	246.43	236.89	241.83
No footswitches	247.64	241.45	244.43
	247.12	241.63	

ANOV

Source		d.f.	m.s.	F
(Class)	A	1	1894.0493	5.9080*
(Footswitches)	B	1	235.4453	.7344
	AB	1	102.6612	.3202
Within				

* p<.05